AUSTRALIAN NATIONAL ANTARCTIC RESEARCH EXPEDITIONS

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a catalogue of strains, 1991

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and H.R. Burton

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AUSTRALIAN COLLECTION OF ANTARCTIC MICROORGANISMS: A CATALOGUE OF STRAINS, 1991

by

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FOREWORD

Research in antarctic microbiology is curiosity driven and seeks to answer basic questions: What microbiota is there? How do microorganisms survive there? What roles do the microbiota play in Antarctic ecosystems?

In order to address the first question, pure cultures of microorganisms are required. In most antarctic ecosystems currently being investigated, members of the bacterial population cannot be identified. Identification of an organism presupposes that it has been encountered previously and described. The organisms collected in Antarctica are new, and have generally represented new species. The International Code of Nomenclature of Bacteria (Lapage et al. 1975) stated that

> "Whenever possible the type of a species is a designated type strain."
> "A type strain is made up of living cultures of an organism which are descended from a strain designated as the nomenclatural type."

Thus, the international rules which govern the naming of bacterial taxa require that whenever possible a living culture representing the taxa should be preserved. There are good reasons for this. As new techniques have become available with which to examine bacterial taxa (e.g. in electron microscopy, lipid chemistry or nucleic acid chemistry) material representative of the species under investigation must be available for examination. Taxonomy is improving and is an evolving science.

Once a culture collection exists there are many uses for the basic resource of authentic bacterial cultures.

In ecology: The quantification of a known physiological group within an ecosystem can be achieved by polyclonal antibodies raised to the living organism grown from culture collection stock. Specific

genes from authentic culture collection strains can be sequenced and probes made to locate these genes in the environment either to locate a taxa (e.g. RNA genes) or to locate a function (e.g. a cellulase gene). In addition, the metabolic potential of each strain to participate in biogeochemical cycling (e.g. sulfur, carbon or nitrogen cycle) can be assessed using authentic cultures.

In physiology: The ability of an organism to tolerate or proliferate under variable parameters can be tested on authentic cultures in the laboratory so as to model an organism's response to environmental stresses or extremes such as those encountered in the Antarctic.

In biotechnology: Authentic strains can be screened for novel attributes suitable for exploitation by man. Recent investigations within ACAM have centred on the production of polyunsaturated fatty acids by cultures or the ability of cultures to degrade anthropogenic contaminants such as hydrocarbons. Although only minor success has been achieved in these two endeavours, the unique gene pool present in these antarctic cultures could always yield useful bioproducts or processes.

1. INTRODUCTION

The Australian Collection of Antarctic Bacteria (ACAM) commenced on 3 February 1986 and is housed at the University of Tasmania. It is affiliated with the Australian Federation of Culture Collections and the World Federation of Culture Collections (WFCC). The World Data Centre for Microorganisms has assigned ACAM the collection number 571 (Staines et al. 1986). ACAM is funded by the Australian Research Council, the University of Tasmania, the Antarctic Science Advisory Committee and the Antarctic Division. It was established as a collection for antarctic microorganisms and accepts strains isolated from the Antarctic continent, subantarctic islands and the Southern Ocean. It will hold reference strains from other geographical locations if their use is applicable to antarctic studies.

ACAM will deposit cultures which are type strains of newly described species or are new strains of known species which possess attributes of special interest. The strains should have been (or are soon to be) documented in the literature. Prior to culture deposition, workers should write to the Curator to give relevant details. At the time of deposition, the depositor must supply a completed WFCC form SCC-4, which is available from ACAM.

Strains held at ACAM are available to any researcher on payment of a fee to cover handling and postage costs. Current handling costs are $80 per culture. Cultures will be freely exchanged with other collections. Cultures may be deposited in the collection for 'safe storage' from which the culture will only be made available to the depositor but special arrangements must be made with the Curator for this service.

Cultures will be stored in a freeze-dried state in most cases. Some strains, which do not survive lyophilisation, will be stored in ampoules under liquid nitrogen, or will be routinely subcultured. Ampoules of lyophilised material are under vacuum and should be opened with care. The dried material should be resuspended in 0·2 mL of appropriate growth media and subcultured into a suitable solid and liquid medium. Media and growth conditions for each culture are listed in the catalogue.

ACAM is a continuously expanding collection, evidenced by a number of strains which are yet to be identified. Research on the taxonomy, ecology and molecular biology of antarctic microorganisms is an integral part of the collection's activities.

2. CATALOGUE

The catalogue has three sections:

1. List of cultures
2. Solutions and media
3. References

The list of cultures gives details of each culture held in the collection. Cultures are listed alphabetically by genus and species names and are listed in order of accession within each species. The details given for each strain are:

1. Generic and specific epithets
2. Accession number
3. Depositor's name and affiliation at the time of deposition
4. Place and date of isolation
5. Growth method which includes medium, temperature and incubation environment
6. Preservation methods and preservation suspending medium
7. A reference to other collection accession numbers if the strain is held elsewhere.
   - ATCC denotes cultures held at the American Type Culture Collection, 12301 Parklawn Drive, Rockville, Maryland 20852, USA.
   - CCM denotes cultures held at the Czechoslovak Collection of Micororganisms, J.E. Purkyne University, Brno, Czechoslovakia.
   - DSM denotes cultures held in the German Collection of Microorganisms and Cell Cultures Mascheroder Weg 1 b, D-3300 Braunschweig, Federal Republic of Germany.
   - ISM denotes cultures held at the Institute of Applied Microbiology, University of Tokyo, Japan.
   - NCMB denotes cultures from the National Collection of Marine Bacteria, 23 St Machar Drive, Aberdeen, Scotland AB2 1RY, UK.
   - NCTC denotes cultures from the National Collection of Type Cultures, Central Public Health Laboratory, 61 Colindale Avenue, London NW9 5HT, UK.
   - UQM denotes cultures held at the Department of Microbiology, University of Queens land, St. Lucia 4067, Queensland, Australia.
8. Special features of the strain (if any)
9. References in the literature (if any)

The solutions and media section details the recipes and methods for the preparation of media required for the cultivation of all the strains listed in the catalogue.

3. LIST OF STRAINS

Acinetobacter sp.

ACAM 136 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 11·3 m, 17/10/84. *Culture conditions:* ZA, aerobic, 25°C. *Preservation method:* Lyophilisation.

Aerococcus viridans

ACAM 292 *Received from:* UQM. *Culture conditions:* 1/3 strength TSA, aerobic, 25°C. *Preservation method:* Lyophilisation. *Strain at other collections as:* UQM 790.

ACAM 293 *Received from:* NCTC. *Isolated from:* Air sample. *Culture conditions:* 1/3 strength TSA, aerobic, 25°C. *Preservation method:* Lyophilisation. *Strain at other collections as:* NCTC 8251.

ACAM 294 *Received from:* NCMB. *Isolated from:* Lobster (*Homarus americanus*). *Culture conditions:* 1/3 strength TSA, aerobic, 25°C. *Preservation method:* Lyophilisation. *Strain at other collections as:* NCMB 679.

ACAM 295 *Received from:* NCMB. *Isolated from:* Moribund lobsters (*Homarus gamarus*) in storage tanks. *Culture conditions:* 1/3 strength TSA, aerobic, 25°C. *Preservation method:* Lyophilisation. *Strain at other collections as:* NCMB 1119.

ACAM 296 *Received from:* NCMB. *Isolated from:* Moribund lobsters (*Homarus gamarus*) in storage tanks. *Culture conditions:* 1/3 strength TSA, aerobic, 25°C. *Preservation method:* Lyophilisation. *Strain at other collections as:* NCMB 1120.

ACAM 297 *Received from:* NCMB. *Isolated from:* Normal apparently healthy lobsters (*Homarus gamarus*). *Culture conditions:* 1/3 strength TSA, aerobic, 25°C. *Preservation method:* Lyophilisation. *Strain at other collections as:* NCMB 11121.

Bacillus macerans

ACAM 337 *Received from:* M. Line (University of Tasmania). *Isolated from:* Soil, Macquarie Island, Australia (54°30'S, 158°55'E), altitude 200 m, 12/90. *Culture conditions:* NA, aerobic, 37°C. *Preservation method:* Lyophilisation. *Special features:* Nitrogen fixation.

Bacillus polymyxa

ACAM 338 *Received from:* M. Line (University of Tasmania). *Isolated from:* Soil, Macquarie Island, Australia (54°30'S, 158°55'E), altitude 200 m, 12/90. *Culture conditions:* NA, aerobic, 37°C. *Preservation method:* Lyophilisation. *Special features:* Nitrogen fixation.

Bacillus sp.

ACAM 196 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 10·3 m, 17/10/84. *Culture conditions:* ZA, aerobic, 25°C. *Preservation method:* Lyophilisation.

Carnobacterium alterfunditum

ACAM 311 *Received from:* DSM. *Isolated from:* Ace Lake, Antarctica (68°24'S, 78°11'E), depth 24 m, 1/4/89. *Culture conditions:* TSA-Artificial marine salts, aerobic in unshaken tubes, anaerobically on agar, 23°C. *Preservation method:* Lyophilisation. *Strain at other collections as:* DSM 5972. *Special features:* Type strain. *References:* Franzmann et al. 1991.

Carnobacterium funditum

ACAM 312 *Received from:* DSM. *Isolated from:* Ace Lake, Antarctica (68°24'S, 78°11'E), depth 24 m, 1/4/89. *Culture conditions:* TSA-Artificial marine salts, aerobic in unshaken tubes, anaerobically on agar, 23°C. *Preservation method:* Lyophilisation. *Strain at other collections as:* DSM 5970. *Special features:* Type strain. *References:* Franzmann et al. 1991.

Cytophaga lytica

ACAM 74 *Received from:* NCMB. *Isolated from:* Mud, Costa Rica. *Culture conditions:* SWYPA, aerobic, 20°C. *Preservation method:* Lyophilisation. *Strain at other collections as:* NCMB 1423. *Special features:* Type strain.

Cytophaga sp.

ACAM 76 *Received from:* NCMB. *Isolated from:* North Sea cod. *Culture conditions:* SWLA, aerobic, 20°C. *Preservation method:* Lyophilisation. *Strain at other collections as:* NCMB 249.

ACAM 77 *Received from:* NCMB. *Isolated from:* North Sea cod. *Culture conditions:* SWLA, aerobic, 20°C. *Preservation method:* Lyophilisation. *Strain at other collections as:* NCMB 251.

Cytophaga xantha

ACAM 81 *Received from:* IAM. *Culture conditions:* PYGA, aerobic, 15°C. *Preservation method:* Lyophilisation. *Strain at other collections as:* IAM 12026. *Special features:* Invalid species name.

Deleya aesta

ACAM 68 *Received from:* NCMB. *Isolated from:* Sea water, 200 m. *Culture conditions:* Marine agar 2216 (Difco), aerobic, 28°C. *Preservation method:* Lyophilisation. *Strain at other collections as:* NCMB 1980. *Special features:* Type strain. *References:* Franzmann et al. 1988.

Deleya aquamarina

ACAM 348 *Received from:* DSM. *Isolated from:* Seawater, surface. *Culture conditions:* Marine agar 2216 (Difco), aerobic, 28°C. *Preservation method:* Lyophilisation. *Strain at other collections as:* DSM 30161, ATCC 14400.

Deleya cupida

ACAM 343 *Received from:* DSM. *Isolated from:* Seawater, surface. *Culture conditions:* Marine agar 2216 (Difco), aerobic, 28°C. *Preservation method:* Lyophilisation. *Strain at other collections as:* DSM 4740, ATCC 27124.

Deleya halophila

ACAM 69 *Received from:* CCM. *Isolated from:* Hypersaline soil. *Culture conditions:* Marine agar 2216 (Difco), aerobic, 28°C. *Preservation method:* Lyophilisation. *Strain at other collections as:* CCM 3662. *Special features:* Type strain.

ACAM 347 *Received from:* DSM. *Isolated from:* Hypersaline soil. *Culture conditions:* Marine agar 2216 (Difco), aerobic, 28°C. *Preservation method:* Lyophilisation. *Strain at other collections as:* DSM 4770, CCM 3662.

Deleya marina

ACAM 344 *Received from:* DSM. *Isolated from:* Seawater, surface. *Culture conditions:* Marine agar 2216 (Difco), aerobic, 28°C. *Preservation method:* Lyophilisation. *Strain at other collections as:* DSM 4741, ATCC 25347.

Deleya pacifica

ACAM 345 *Received from:* DSM. *Isolated from:* Seawater, surface. *Culture conditions:* Marine agar 2216 (Difco), aerobic, 28°C. *Preservation method:* Lyophilisation. *Strain at other collections as:* DSM 4742, ATCC 27122.

Deleya venusta

ACAM 346 *Received from:* DSM. *Isolated from:* Seawater, surface. *Culture conditions:* Marine agar 2216 (Difco), aerobic, 28°C. *Preservation method:* Lyophilisation. *Strain at other collections as:* DSM 4743, ATCC 27125.

Escherichia coli

ACAM 82 *Received from:* UQM. *Culture conditions:* NA, aerobic, 37°C. *Preservation method:* Lyophilisation. *Strain at other collections as:* UQM 1803. *Special features:* Type strain.

Flavobacterium gondwanense

ACAM 1 *Received from:* P.D. Franzmann (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 3 m, 24/10/84. *Culture conditions:* SWYA or Marine Agar 2216 (Difco), aerobic, 25°C. *Preservation method:* Lyophilisation. *References:* Dobson et al. 1991, Dobson et al. (in preparation).

ACAM 40 *Received from:* D. Cameron (ACAM). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 2 m, 1/5/86. *Culture conditions:* SWYA or Marine Agar 2216 (Difco), aerobic, 25°C. *Preservation method:* Lyophilisation. *References:* Dobson et al. 1991, Dobson et al. (in preparation).

ACAM 41 *Received from:* D. Cameron (ACAM). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 2 m, 1/5/86. *Culture conditions:* SWYA or Marine Agar 2216 (Difco), aerobic, 25°C. *Preservation method:* Lyophilisation. *References:* Dobson et al. 1991, Dobson et al. (in preparation).

ACAM 43 *Received from:* D. Cameron (ACAM). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 5 m, 1/5/86. *Culture conditions:* SWYA or Marine Agar 2216 (Difco), aerobic, 25°C. *Preservation method:* Lyophilisation. *References:* Dobson et al. 1991, Dobson et al. (in preparation).

ACAM 44 *Received from:* D. Cameron (ACAM). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 5 m, 1/5/86. *Culture conditions:* SWYA or Marine Agar 2216 (Difco), aerobic, 25°C. *Preservation method:* Lyophilisation. *Special features:* Type strain. *References:* Dobson et al. 1991, Dobson et al. (in preparation).

ACAM 45 *Received from:* D. Cameron (ACAM). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 5 m, 1/5/86. *Culture conditions:* SWYA or Marine Agar 2216 (Difco), aerobic, 25°C. *Preservation method:* Lyophilisation. *References:* Dobson et al. 1991, Dobson et al. (in preparation).

ACAM 46 *Received from:* D. Cameron (ACAM). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 5 m, 1/5/86. *Culture conditions:* SWYA or Marine Agar 2216 (Difco), aerobic, 25°C. *Preservation method:* Lyophilisation. *References:* Dobson et al. 1991, Dobson et al. (in preparation).

ACAM 49 *Received from:* D. Cameron (ACAM). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 4 m, 1/5/86. *Culture conditions:* SWYA or Marine Agar 2216 (Difco), aerobic, 25°C. *Preservation method:* Lyophilisation. *References:* Dobson et al. 1991, Dobson et al. (in preparation).

ACAM 55 *Received from:* D. Cameron (ACAM). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 2 m, 1/5/86. *Culture conditions:* SWYA or Marine Agar 2216 (Difco), aerobic, 25°C. *Preservation method:* Lyophilisation. *References:* Dobson et al. (in preparation).

ACAM 62 *Received from:* D. Cameron (ACAM). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E) , depth 2 m, 1/5/86. *Culture conditions:* SWYA or Marine Agar 2216 (Difco), aerobic, 25°C. *Preservation method:* Lyophilisation. *References:* Dobson et al. (in preparation).

Flavobacterium indoltheticum

ACAM 72 *Received from:* NCMB. *Isolated from:* Marine mud. *Culture conditions:* SWLA, aerobic, 25°C. *Preservation method:* Lyophilisation. *Strain at other collections as:* NCMB 2220. *Special features:* Type strain.

Flavobacterium salegens

ACAM 2 *Received from:* P.D. Franzmann (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 2 m, 24/10/84. *Culture conditions:* SWYA or Marine Agar 2216 (Difco), aerobic, 25°C. *Preservation method:* Lyophilisation. *References:* Dobson et al. 1991, Dobson et al. (in preparation).

ACAM 48 *Received from:* D. Cameron (ACAM). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 4 m, 1/5/86. *Culture conditions:* SWYA or Marine Agar 2216 (Difco), aerobic, 25°C. *Preservation method:* Lyophilisation. *Special features:* Type strain. *References:* Dobson et al. 1991, Dobson et al. (in preparation).

ACAM 52 *Received from:* D. Cameron (ACAM). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 3 m, 1/5/86. *Culture conditions:* SWYA or Marine Agar 2216 (Difco), aerobic, 25°C. *Preservation method:* Lyophilisation. *References:* Dobson et al. 1991, Dobson et al. (in preparation).

ACAM 53 *Received from:* D. Cameron (ACAM). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 3 m, 1/5/86. *Culture conditions:* SWYA or Marine Agar 2216 (Difco), aerobic, 25°C. *Preservation method:* Lyophilisation. *References:* Dobson et al. 1991, Dobson et al. (in preparation).

ACAM 54 *Received from:* D. Cameron (ACAM). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 3 m, 1/5/86. *Culture conditions:* SWYA or Marine Agar 2216 (Difco), aerobic, 25°C. *Preservation method:* Lyophilisation. *References:* Dobson et al. 1991, Dobson et al. (in preparation).

Flavobacterium sp.

ACAM 78 *Received from:* NCMB. *Isolated from:* North Sea cod. *Culture conditions:* SWLA, aerobic, 20°C. *Preservation method:* Lyophilisation. *Strain at other collections as:* NCMB 259.

Flectobacillus glomeratus

ACAM 111 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Prydz Bay offshore from Davis Base, Antarctica (68°34·6'S, 77°58'E), surface seawater, 6/6/09. *Culture conditions:* ZA, aerobic, 25°C. *Preservation method:* Lyophilisation. *References:* McGuire et al. 1987.

ACAM 171 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 11 m, 17/10/84. *Culture conditions:* 1/2 SWA, aerobic, 15°C. *Preservation method:* Lyophilisation. *Strain at other collections as:* UQM 3055. *Special features:* Type strain. *References:* McGuire et al. 1987.

Flexibacter sp.

ACAM 79 *Received from:* NCMB. *Isolated from:* North Sea cod. *Culture conditions:* SWLA, aerobic, 20°C. *Preservation method:* Lyophilisation. *Strain at other collections as:* NCMB 275.

Halobacterium lacusprofundi

ACAM 32 *Received from:* K. Sanderson (University of Tasmania). *Isolated from:* Deep Lake, Antarctica (68°33·6'S, 78°11·6'E), sediment-water interface, 15/6/84. *Culture conditions:* ADLSVA, aerobic, 30°C. *Preservation method:* Lyophilisation. *Strain at other collections as:* ATCC 49238, DSM 5037. *References:* Franzmann et al. 1988.

ACAM 34 *Received from:* K. Sanderson (University of Tasmania). *Isolated from:* Deep Lake, Antarctica (68°33·6'S, 78°11·6'E), sediment-water interface, 15/6/84. *Culture conditions:* ADLSVA, aerobic, 30°C. *Preservation method:* Lyophilisation, (FDSM#2). *Strain at other collections as:* UQM 3107, ATCC 49239, DSM 49239. *Special features:* Type strain. *References:* Franzmann et al. 1988.

Halobacterium saccharovorum

ACAM 66 *Received from:* NCMB. *Isolated from:* Saltern, San Fancisco Bay. *Culture conditions:* ADLSVA, aerobic, 30°C. *Preservation method:* Lyophilisation. *Strain at other collections as:* NCMB 2081.

Haloferax volcanii

ACAM 67 *Received from:* NCMB. *Isolated from:* Dead Sea mud, Israel. *Culture conditions:* ADLSVA, aerobic, 30°C. *Preservation method:* Lyophilisation. *Strain at other collections as:* NCMB 2012.

Halomonas elongata

ACAM 35 *Received from:* ATCC. *Isolated from:* Solar salt facility, Dutch Antilles, salt water. *Culture conditions:* AOLPA, aerobic, 25°C. *Preservation method:* Lyophilisation. *Strain at other collections as:* ATCC 33173, UQM 2924. *Special features:* Type strain. *References:* Vreeland et al. 1980.

Halomonas halmophila

ACAM 71 *Received from:* NCMB. *Isolated from:* Dead Sea, Israel. *Culture conditions:* SWLA , aerobic, 25°C. *Preservation method:* Lyophilisation. *Strain at other collections as:* NCMB 1971. *Special features:* Type strain. *References:* Dobson et al. 1990.

Halomonas meridiana

ACAM 233 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 2 m, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation. *Strain at other collections as:* ATCC 49693, UQM 3352. *Special features:* Biovar I. *References:* James et al. 1990.

ACAM 235 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* the lake on Lake Island, Antarctica (68°33'S, 77°59'E), depth 1 m, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation. *References:* James et al. 1990.

ACAM 236 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Laternula Lake, Antarctica (68°41'S, 77°58'E), surface, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation. *References:* James et al. 1990.

ACAM 239 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Williams Lake, Antarctica (68°28'S, 78°09'E), depth 6 m, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation. *References:* James et al. 1990.

ACAM 242 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Burch Lake, Antarctica (68°27'S, 78°16'E), depth 6 m, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation. *References:* James et al. 1990.

ACAM 246 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Burch Lake, Antarctica (68°27'S, 78°16'E), depth 6 m, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation. *Strain at other collections as:* ATCC 49692, UQM 3353. *Special features:* Type strain, biovar II. *References:* James et al. 1990.

ACAM 253 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Williams Lake, Antarctica (68°28'S, 78°09'E) Bay, depth 1 m, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation. *References:* James et al. 1990.

Halomonas sp.

ACAM 247 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 3 m, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation. *References:* James et al. 1990.

ACAM 254 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 5 m, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation. *References:* James et al. 1990.

Halomonas subglaciescola

ACAM 3 *Received from:* P.D. Franzmann (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 7 m, 24/10/84. *Culture conditions:* AOLPA, aerobic, 30°C. *Preservation method:* Lyophilisation. *References:* Franzmann et al. 1987.

ACAM 4 *Received from:* P.D. Franzmann (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 7 m, 24/10/84. *Culture conditions:* AOLPA, aerobic, 30°C. *Preservation method:* Lyophilisation. *References:* Franzmann et al. 1987.

ACAM 5 *Received from:* P.D. Franzmann (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 3 m, 24/10/84. *Culture conditions:* AOLPA, aerobic, 30°C. *Preservation method:* Lyophilisation. *References:* Franzmann et al. 1987.

ACAM 6 *Received from:* P.D. Franzmann (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 3 m, 24/10/84. *Culture conditions:* AOLPA, aerobic, 30°C. *Preservation method:* Lyophilisation. *References:* Franzmann et al. 1987.

ACAM 7 *Received from:* P.D. Franzmann (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 3 m, 24/10/84. *Culture conditions:* AOLPA, aerobic, 30°C. *Preservation method:* Lyophilisation. *References:* Franzmann et al. 1987.

ACAM 8 *Received from:* P.D. Franzmann (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 3 m, 24/10/84. *Culture conditions:* AOLPA, aerobic, 30°C. *Preservation method:* Lyophilisation. *References:* Franzmann et al. 1987.

ACAM 9 *Received from:* P.D. Franzmann (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 3 m, 24/10/84. *Culture conditions:* AOLPA, aerobic, 30°C. *Preservation method:* Lyophilisation. *References:* Franzmann et al. 1987.

ACAM 10 *Received from:* P.D. Franzmann (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 2 m, 24/10/84. *Culture conditions:* AOLPA, aerobic, 30°C. *Preservation method:* Lyophilisation. *References:* Franzmann et al. 1987.

ACAM 11 *Received from:* P.D. Franzmann (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 2 m, 24/10/84. *Culture conditions:* AOLPA, aerobic, 30°C. *Preservation method:* Lyophilisation. *References:* Franzmann et al. 1987.

ACAM 12 *Received from:* P.D. Franzmann (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 2 m, 24/10/84. *Culture conditions:* AOLPA, aerobic, 30°C. *Preservation method:* Lyophilisation. *Strain at other collections as:* UQM 2926, ATCC 43668, DSM 4683. *Special features:* Type strain, biovar I. *References:* Franzmann et al. 1987, Franzmann et al. 1988.

ACAM 13 *Received from:* P.D. Franzmann (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 5 m, 24/10/84. *Culture conditions:* AOLPA, aerobic, 30°C. *Preservation method:* Lyophilisation. *References:* Franzmann et al. 1987.

ACAM 14 *Received from:* P.D. Franzmann (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 5 m, 24/10/84. *Culture conditions:* AOLPA, aerobic, 30°C. *Preservation method:* Lyophilisation. *References:* Franzmann et al. 1987.

ACAM 15 *Received from:* P.D. Franzmann (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 7 m, 24/10/84. *Culture conditions:* AOLPA, aerobic, 30°C. *Preservation method:* Lyophilisation. *References:* Franzmann et al. 1987.

ACAM 16 *Received from:* P.D. Franzmann (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 3 m, 24/10/84. *Culture conditions:* AOLPA, aerobic, 30°C. *Preservation method:* Lyophilisation. *References:* Franzmann et al. 1987.

ACAM 17 *Received from:* P.D. Franzmann (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 3 m, 24/10/84. *Culture conditions:* AOLPA, aerobic, 30°C. *Preservation method:* Lyophilisation. *References:* Franzmann et al. 1987.

ACAM 18 *Received from:* P.D. Franzmann (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 3 m, 24/10/84. *Culture conditions:* AOLPA, aerobic, 30°C. *Preservation method:* Lyophilisation. *References:* Franzmann et al. 1987.

ACAM 19 *Received from:* P.D. Franzmann (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 4 m, 24/10/84. *Culture conditions:* AOLPA, aerobic, 30°C. *Preservation method:* Lyophilisation. *References:* Franzmann et al. 1987.

ACAM 20 *Received from:* P.D. Franzmann (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 4 m, 24/10/84. *Culture conditions:* AOLPA, aerobic, 30°C. *Preservation method:* Lyophilisation. *References:* Franzmann et al. 1987.

ACAM 21 *Received from:* P.D. Franzmann (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 4 m, 24/10/84. *Culture conditions:* AOLPA, aerobic, 30°C. *Preservation method:* Lyophilisation. *Strain at other collections as:* UQM 2927, ATCC 43669, DSM 4684. *Special features:* Reference strain biovar II. *References:* Franzmann et al. 1987.

ACAM 22 *Received from:* P.D. Franzmann (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 4 m, 24/10/84. *Culture conditions:* AOLPA, aerobic, 30°C. *Preservation method:* Lyophilisation. *References:* Franzmann et al. 1987.

ACAM 23 *Received from:* P.D. Franzmann (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 5 m, 24/10/84. *Culture conditions:* AOLPA, aerobic, 30°C. *Preservation method:* Lyophilisation. *References:* Franzmann et al. 1987.

ACAM 24 *Received from:* P.D. Franzmann (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 5 m, 24/10/84. *Culture conditions:* AOLPA, aerobic, 30°C. *Preservation method:* Lyophilisation. *References:* Franzmann et al. 1987.

ACAM 25 *Received from:* P.D. Franzmann (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 5 m, 24/10/84. *Culture conditions:* AOLPA, aerobic, 30°C. *Preservation method:* Lyophilisation. *Strain at other collections as:* UQM 2925. *References:* Franzmann et al. 1987.

ACAM 26 *Received from:* P.D. Franzmann (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 5 m, 24/10/84. *Culture conditions:* AOLPA, aerobic, 30°C. *Preservation method:* Lyophilisation. *References:* Franzmann et al. 1987.

ACAM 27 *Received from:* P.D. Franzmann (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 5 m, 24/10/84. *Culture conditions:* AOLPA, aerobic, 30°C. *Preservation method:* Lyophilisation. *References:* Franzmann et al. 1987.

ACAM 28 *Received from:* P.D. Franzmann (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 6 m, 24/10/84. *Culture conditions:* AOLPA, aerobic, 30°C. *Preservation method:* Lyophilisation. *References:* Franzmann et al. 1987.

ACAM 29 *Received from:* P.D. Franzmann (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 6 m, 24/10/84. *Culture conditions:* AOLPA, aerobic, 30°C. *Preservation method:* Lyophilisation. *References:* Franzmann et al. 1987.

ACAM 30 *Received from:* P.D. Franzmann (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 6 m, 24/10/84. *Culture conditions:* AOLPA, aerobic, 30°C. *Preservation method:* Lyophilisation. *References:* Franzmann et al. 1987.

ACAM 31 *Received from:* P.D. Franzmann (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 6 m, 24/10/84. *Culture conditions:* AOLPA, aerobic, 30°C. *Preservation method:* Lyophilisation. *References:* Franzmann et al. 1987.

ACAM 221 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 4 m, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation. *References:* James et al. 1990.

ACAM 222 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Laternula Lake, Antarctica (68°41'S, 77°58'E), surface, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation. *References:* James et al. 1990.

ACAM 223 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 3 m, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation. *References:* James et al. 1990.

ACAM 224 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 6 m, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation. *References:* James et al. 1990.

ACAM 225 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 5 m, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation. *References:* James et al. 1990.

ACAM 227 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 6 m, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation. *References:* James et al. 1990.

ACAM 229 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 5 m, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation. *References:* James et al. 1990.

ACAM 230 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 1 m, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation. *References:* James et al. 1990.

ACAM 231 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 6 m, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation. *References:* James et al. 1990.

ACAM 234 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 1 m, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation. *References:* James et al. 1990.

ACAM 250 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 4 m, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation. *References:* James et al. 1990.

ACAM 251 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 3 m, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation. *References:* James et al. 1990.

ACAM 252 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 7 m, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation. *References:* James et al. 1990.

ACAM 255 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 6 m, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation. *References:* James et al. 1990.

ACAM 256 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 1 m, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation. *References:* James et al. 1990.

ACAM 258 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Burch Lake, Antarctica (68°27'S, 78°16'E) Bay, depth 6 m, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation.

ACAM 259 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 6 m, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation. *References:* James et al. 1990.

Pediococcus halophilus

ACAM 290 *Received from:* DSM. *Culture conditions:* 1/3 strength TSA, aerobic, 25°C. *Preservation method:* Lyophilisation. *Strain at other collections as:* DSM 20339. *Special features:* Type strain.

Pediococcus urinaeequi

ACAM 291 *Received from:* DSM. *Isolated from:* Horse urine. *Culture conditions:* 1/3 strength TSA, aerobic, 25°C. *Preservation method:* Lyophilisation. *Strain at other collections as:* DSM 20341.

Pseudomonas sp.

ACAM 113 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 10 m, 17/8/84. *Culture conditions:* ZA, aerobic, 15°C. *Preservation method:* Lyophilisation.

ACAM 119 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 10·8 m, 15/9/84. *Culture conditions:* ZA, aerobic, 15°C. *Preservation method:* Lyophilisation.

ACAM 122 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 10·7 m, 15/9/84. *Culture conditions:* ZA, aerobic, 25°C. *Preservation method:* Lyophilisation.

ACAM 124 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 1 m, 15/9/84. *Culture conditions:* ZA, aerobic, 25°C. *Preservation method:* Lyophilisation.

ACAM 125 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 1 m, 15/9/84. *Culture conditions:* ZA, aerobic, 25°C. *Preservation method:* Lyophilisation.

ACAM 146 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 11·2 m, 17/10/84. *Culture conditions:* ZA, aerobic, 15°C. *Preservation method:* Lyophilisation.

ACAM 147 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 11·2 m, 17/10/84. *Culture conditions:* ZA, aerobic, 25°C. *Preservation method:* Lyophilisation.

ACAM 148 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 12 m, 17/10/84. *Culture conditions:* ZA, aerobic, 25°C. *Preservation method:* Lyophilisation.

ACAM 150 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 12 m, 17/10/84. *Culture conditions:* ZA, aerobic, 15°C. *Preservation method:* Lyophilisation.

ACAM 151 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 12·3 m, 17/10/84. *Culture conditions:* ZA, aerobic, 15°C. *Preservation method:* Lyophilisation.

ACAM 159 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 11·2 m, 17/10/84. *Culture conditions:* 1/2 SWA, aerobic, 25°C. *Preservation method:* Lyophilisation.

ACAM 162 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 11·8 m, 17/10/84. *Culture conditions:* ZA, aerobic, 15°C. *Preservation method:* Lyophilisation.

ACAM 166 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 11·5 m, 17/10/84. *Culture conditions:* ZA, aerobic, 15°C. *Preservation method:* Lyophilisation.

ACAM 188 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 10·4 m, 17/10/84. *Culture conditions:* ZA, aerobic, 15°C. *Preservation method:* Lyophilisation.

ACAM 192 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 10·4 m, 17/10/84. *Culture conditions:* ZA, aerobic, 25°C. *Preservation method:* Lyophilisation.

Rhodopseudomonas sp.

ACAM 33 *Received from:* C. Burke (Antartic Division). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 9·1 m, 7/11/85. *Culture conditions:* RA, Anaerobic, light, 25°C. *Preservation method:* Lyophilisation. *Special features:* Unpigmented if grown aerobically in dark.

ACAM 243 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 5 m, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation.

Shewanella putrefaciens

ACAM 341 *Received from*: D. Nichols (ACAM). *Isolated from*: Spoiled chicken, Tasmania, Australia. *Culture conditions:* ZA, aerobic, 15°C. *Preservation method:* Lyophilisation. *Special features*: Psychrotroph, production of C18 and C20 polyunsaturated fatty acids.

Unidentified

ACAM 42 *Received from:* D. Cameron (ACAM). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 2 m, 1/5/86. *Culture conditions:* SWYA or Marine Agar 2216 (Difco), aerobic, 25°C. *Preservation method:* Lyophilisation.

ACAM 56 *Received from:* D. Cameron (ACAM). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 2 m, 1/5/86. *Culture conditions:* SWYA or Marine Agar 2216 (Difco), aerobic, 25°C. *Preservation method:* Lyophilisation.

ACAM 101 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 2 m, 15/5/84. *Culture conditions:* ZA, aerobic, 15°C. *Preservation method:* Lyophilisation.

ACAM 116 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 6 m, 15/9/84. *Culture conditions:* ZA, aerobic, 15°C. *Preservation method:* Lyophilisation.

ACAM 118 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 11·7 m, 15/9/84. *Culture conditions:* ZA, aerobic, 25°C. *Preservation method:* Lyophilisation.

ACAM 123 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 10·3 m, 15/9/84. *Culture conditions:* ZA, aerobic, 15°C. *Preservation method:* Lyophilisation.

ACAM 129 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 3 m, 15/9/84. *Culture conditions:* ZA, aerobic, 25°C. *Preservation method:* Lyophilisation.

ACAM 139 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 11·4 m, 17/10/84. *Culture conditions:* ZA, aerobic, 15°C. *Preservation method:* Lyophilisation.

ACAM 140 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 11·4 m, 17/10/84. *Culture conditions:* ZA, aerobic, 15°C. *Preservation method:* Lyophilisation.

ACAM 142 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 11· 7 m, 17/10/84. *Culture conditions:* ZA, aerobic, 15°C. *Preservation method:* Lyophilisation.

ACAM 143 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 11·7 m, 17/10/84. *Culture conditions:* ZA, aerobic, 15°C. *Preservation method:* Lyophilisation.

ACAM 145 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 11·2 m, 17/10/84. *Culture conditions:* ZA, aerobic, 15°C. *Preservation method:* Lyophilisation.

ACAM 149 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 12 m, 17/10/84. *Culture conditions:* ZA, aerobic, 15°C. *Preservation method:* Lyophilisation.

ACAM 156 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 12·2 m, 17/10/84. *Culture conditions:* ZA, aerobic, 25°C. *Preservation method:* Lyophilisation.

ACAM 167 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 10·7 m, 17/10/84. *Culture conditions:* ZA, aerobic, 15°C. *Preservation method:* Lyophilisation.

ACAM 172 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 11 m, 17/10/84. *Culture conditions:* ZA, aerobic, 25°C. *Preservation method:* Lyophilisation.

ACAM 178 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 10·5 m, 17/10/84. *Culture conditions:* ZA, aerobic, 25°C. *Preservation method:* Lyophilisation.

ACAM 179 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 10·5 m, 17/10/84. *Culture conditions:* ZA, aerobic, 15°C. *Preservation method:* Lyophilisation.

ACAM 181 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 11·6 m, 17/10/84. *Culture conditions:* ZA, aerobic, 15°C. *Preservation method:* Lyophilisation.

ACAM 207 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 7 m, 17/10/84. *Culture conditions:* ZA, aerobic, 25°C. *Preservation method:* Lyophilisation.

ACAM 210 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 8 m, 17/10/84. *Culture conditions:* ZA, aerobic, 15°C. *Preservation method:* Lyophilisation.

ACAM 213 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 10·4 m, 17/10/84. *Culture conditions:* ZA, aerobic, 25°C. *Preservation method:* Lyophilisation.

ACAM 220 *Received from:* A.J. McGuire (University of Tasmania). *Isolated from:* Burton Lake, Antarctica (68°37·5'S, 78°05'E), depth 5 m, 17/10/84. *Culture conditions:* ZA, aerobic, 15°C. *Preservation method:* Lyophilisation.

ACAM 226 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 5 m, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation.

ACAM 228 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 6 m, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation.

ACAM 232 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 5 m, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation.

ACAM 237 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 4 m, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation.

ACAM 238 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 3 m, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation.

ACAM 240 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 1 m, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation.

ACAM 241 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 3 m, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation.

ACAM 244 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 6 m , 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation.

ACAM 245 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 6 m, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation.

ACAM 248 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 6 m, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation.

ACAM 249 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 3 m, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation.

ACAM 257 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 6·5 m, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation.

ACAM 260 *Received from:* R.C. Garrick (Antarctic Division). *Isolated from:* Organic Lake, Antarctica (68°27·2'S, 78°12·3'E), depth 6·5 m, 4/87. *Culture conditions:* AOLPA 3%, aerobic, 25°C. *Preservation method:* Lyophilisation.

ACAM 282 *Received from:* J.J. Austin (ACAM). *Isolated from:* Adélie penguin guano, Magnetic Island, Antarctica (68°32·30'S, 77°54·30'E), surface, 4/90. *Culture conditions:* 1/3 strength TSA, aerobic, 25°C. *Preservation method:* Lyophilisation.

ACAM 283 *Received from:* J.J. Austin (ACAM). *Isolated from:* Adélie penguin guano, Magnetic Island, Antarctica (68°32·30'S, 77°54·30'E), surface, 4/90. *Culture conditions:* 1/3 strength TSA, microaerophillic, 25°C. *Preservation method:* Lyophilisation.

ACAM 284 *Received from:* J.J. Austin (ACAM). *Isolated from:* Adélie penguin guano, Magnetic Island, Antarctica (68°32·30'S, 77°54·30'E), surface, 4/90. *Culture conditions:* 1/3 strength TSA, microaerophillic, 25°C. *Preservation method:* Lyophilisation.

ACAM 285 *Received from:* J.J. Austin (ACAM). *Isolated from:* Adélie penguin guano, Magnetic Island, Antarctica (68°32·30'S, 77°54·30'E), surface, 4/90. *Culture conditions:* 1/3 strength TSA, microaerophillic, 25°C. *Preservation method:* Lyophilisation.

ACAM 286 *Received from:* J.J. Austin (ACAM). *Isolated from:* Adélie penguin guano, Magnetic Island, Antarctica (68°32·30'S, 77°54·30'E), surface, 4/90. *Culture conditions:* 1/3 strength TSA, microaerophillic, 25°C. *Preservation method:* Lyophilisation.

ACAM 287 *Received from:* J.J. Austin (ACAM). *Isolated from:* Adélie penguin guano, Magnetic Island, Antarctica (68°32·30'S, 77°54·30'E), surface, 4/90. *Culture conditions:* 1/3 strength TSA, microaerophillic, 25°C. *Preservation method:* Lyophilisation.

ACAM 288 *Received from:* J.J. Austin (ACAM). *Isolated from:* Adélie penguin guano, Magnetic Island, Antarctica (68°32·30'S, 77°54·30'E), surface, 4/90. *Culture conditions:* 1/3 strength TSA, aerobic, 25°C. *Preservation method:* Lyophilisation.

ACAM 289 *Received from:* J.J. Austin (ACAM). *Isolated from:* Adélie penguin guano, Magnetic Island, Antarctica (68°32·30'S, 77°54·30'E), surface, 4/90. *Culture conditions:* 1/3 strength TSA, aerobic, 25°C. *Preservation method:* Lyophilisation.

ACAM 298 *Received from:* J.J. Austin (ACAM). *Isolated from:* Adélie penguin guano, Magnetic Island, Antarctica (68°32·30'S, 77°54·30'E), surface, 4/90. *Culture conditions:* 1/3 strength TSA, aerobic, 25°C. *Preservation method:* Lyophilisation.

ACAM 299 *Received from:* J.J. Austin (ACAM). *Isolated from:* Adélie penguin guano, Magnetic Island, Antarctica (68°32·30'S, 77°54·30'E), surface, 4/90. *Culture conditions:* 1/3 strength TSA, aerobic, 25°C. *Preservation method:* Lyophilisation.

ACAM 300 *Received from:* J.J. Austin (ACAM). *Isolated from:* Adélie penguin guano, Magnetic Island, Antarctica (68°32·30'S, 77°54·30'E), surface, 4/90. *Culture conditions:* 1/3 strength TSA, aerobic, 25°C. *Preservation method:* Lyophilisation.

ACAM 302 *Received from:* J.J. Austin (ACAM). *Isolated from:* Adélie penguin guano, Magnetic Island, Antarctica (68°32·30'S, 77°54·30'E), surface, 4/90. *Culture conditions:* 1/3 strength TSA, microaerophillic, 25°C. *Preservation method:* Lyophilisation.

ACAM 303 *Received from:* J.J. Austin (ACAM). *Isolated from:* Adélie penguin guano, Magnetic Island, Antarctica (68°32·30'S, 77°54·30'E), surface, 4/90. *Culture conditions:* 1/3 strength TSA, aerobic, 10°C. *Preservation method:* Lyophilisation.

ACAM 304 *Received from:* J.J. Austin (ACAM). *Isolated from:* Adélie penguin guano, Magnetic Island, Antarctica (68°32·30'S, 77°54·30'E), surface, 4/90. *Culture conditions:* 1/3 strength TSA, aerobic, 10°C. *Preservation method:* Lyophilisation.

ACAM 305 *Received from:* J.J. Austin (ACAM). *Isolated from:* Adélie penguin guano, Magnetic Island, Antarctica (68°32·30'S, 77°54·30'E), surface, 4/90. *Culture conditions:* 1/3 strength TSA, microaerophillic, 10°C. *Preservation method:* Lyophilisation.

ACAM 306 *Received from:* J.J. Austin (ACAM). *Isolated from:* Adélie penguin guano, Magnetic Island, Antarctica (68°32·30'S, 77°54·30'E), surface, 4/90. *Culture conditions:* 1/3 strength TSA, aerobic, 10°C. *Preservation method:* Lyophilisation.

ACAM 307 *Received from:* J.J. Austin (ACAM). *Isolated from:* Adélie penguin guano, Magnetic Island, Antarctica (68°32·30'S, 77°54·30'E), surface, 4/90. *Culture conditions:* 1/3 strength TSA, aerobic, 10°C. *Preservation method:* Lyophilisation.

ACAM 308 *Received from:* J.J. Austin (ACAM). *Isolated from:* Adélie penguin guano, Magnetic Island, Antarctica (68°32·30'S, 77°54·30'E), surface, 4/90. *Culture conditions:* 1/3 strength TSA, aerobic, 10°C. *Preservation method:* Lyophilisation.

ACAM 309 *Received from:* J.J. Austin (ACAM). *Isolated from:* Adélie penguin guano, Magnetic Island, Antarctica (68°32·30'S, 77°54·30'E), surface, 4/90. *Culture conditions:* 1/3 strength TSA, microaerophillic, 10°C. *Preservation method:* Lyophilisation.

ACAM 310 *Received from:* J.J. Austin (ACAM). *Isolated from:* Adélie penguin guano, Magnetic Island, Antarctica (68°32·30'S, 77°54·30'E), surface, 4/90. *Culture conditions:* 1/3 strength TSA, microaerophillic, 10°C. *Preservation method:* Lyophilisation.

ACAM 311 *Received from:* J.J. Austin (ACAM). *Isolated from:* Adéie penguin guano, Magnetic Island, Antarctica (68°32·30'S, 77°54·30'E), surface, 4/90. *Culture conditions:* 1/3 strength TSA, microaerophillic, 10°C. *Preservation method:* Lyophilisation.

ACAM 339 *Received from:* J.J. Austin (ACAM). *Isolated from:* Adélie penguin guano, Magnetic Island, Antarctica (68°32·30'S, 77°54·30'E), surface, 4/90. *Culture conditions:* 1/3 strength TSA, aerobic, 10°C. *Preservation method:* Lyophilisation. *Special features:* Chitinolytic.

ACAM 340 *Received from:* J.J. Austin (ACAM). *Isolated from:* Adélie penguin guano, Magnetic Island, Antarctica (68°32·30'S, 77°54·30'E), surface, 4/90. *Culture conditions:* 1/3 strength TSA, aerobic, 10°C. *Preservation method:* Lyophilisation. *Special features:* Chitinolytic.

ACAM 342 *Received from:* D. Nichols (ACAM). *Isolated from:* Seawater, Eaglehawk Neck, Tasmania, Australia, surface, 2/91. *Culture conditions:* ZA, aerobic, 15°C. *Preservation method:* Lyophilisation. *Special features:* Psychrotroph.

4. MEDIA LIST

Unless otherwise stated all solutions and media are sterilised at 121°C for 15 minutes.

Solutions:

S1. Metals 44 (M 44) (Staley 1981)

EDTA (Ethylenediaminetetraacetic acid)	2·5 g
$ZnSO_4 \cdot 7H_2O$	10·95 g
$FeSO_4 \cdot 7H_2O$	5·0 g
$MnSO_4 \cdot H_2O$	1·54 g
$CuSO_4 \cdot 5H_2O$	0·392 g
$CoCl_2 \cdot 6H_2O$	0·203 g
$Na_2B_4O_7 \cdot 10H_2O$	0·177 g
Distilled water to	1·0 L

Acidify 500 mL of distilled water with a few drops of H_2SO_4. Dissolve the ingredients and make up to volume with distilled water.

S2. Hutner's modified salts solution (HMSS) (Staley 1981)

Nitrilotriacetic acid	10·0 g
$MgSO_4 \cdot 7H_2O$	29·7 g
$CaCl_2 \cdot 2H_2O$	3·3 g
$NaMoO_4 \cdot 2H_2O$	12·7 mg
$FeSO_4 \cdot H_2O$	99·0 mg
Metals 44 (S1)	50·0 mL
Distilled water to	1·0 L

Neutralise the nitrilotriacetic acid with KOH. Dissolve the remaining ingredients and adjust the pH to 7·2 with KOH or H_2SO_4. Sterilise and store at 4°C.

S3. Phosphate supplement (PS)

K_2HPO4	2·5 g
KH_2PO4	2·5 g
Distilled water to	1·0 L

Dissolve and sterilise. Store at 4°C.

S4. Artificial Organic Lake vitamin solution (AOLV) (Staley 1981)

Cyanocobalamin	0·1 mg
Biotin	2·0 mg
Calcium pantothenate	5·0 mg
Folic acid	2·0 mg
Nicotinamide	5·0 mg
Pyridoxine HCl	10·0 mg
Riboflavin	5·0 mg
Thiamine HCl	5·0 mg
Distilled water to	1·0 L

Dissolve and sterilise by filtration (0·2 μm). Store at 4°C.

S5. Artificial Deep Lake vitamin solution (ADLV) (Franzmann et al. 1988)

Biotin	0·1 g
Cyanocobalamin	0·1 g
Thiamine HCl	0·1 g
Distilled water to	1·0 L

Dissolve and sterilise by filtration (0·2 μm). Store at 4°C.

S6. Trace element solution (Biebl and Pfennig 1981)

HCl 25% (vol/vol)	1·0 mL
$ZnCl_2$	70·0 mg
$MnCl_2 \cdot 4H_2O$	100·0 mg
H_3BO_3	60·0 mg
$CoCl_2 \cdot 6H_2O$	200·0 mg
$CuCl_2 \cdot 2H_2O$	20·0 mg
$NiCl_2 \cdot 6H_2O$	20·0 mg
$NaMoO_4 \cdot 2H_2O$	40·0 mg
Distilled water to	1·0 L

Dissolve and store at 4°C.

S7. Cyanocobalamin stock solution (0·001%) (Biebl and Pfennig 1981)

Dissolve 1·0 mg of cyanocobalamin in 100·0 mL of distilled water. Sterilise by filtration (0·2 μm). Store at 4°C.

S8. Freeze drying suspension media (FDSM)

Prepare a 10% (wt/vol) skim milk in distilled water solution. Dispense 0·2 mL into prepared ampoules, seal with cotton plug and sterilise at 108°C for 30 minutes. When cool, freeze then freeze-dry. Aseptically add one drop only of cells suspended in growth media directly onto freeze-dried milk pellet. Partially constrict ampoule in flame. Place on manifold on freeze-drier. Freeze-dry for 5 hours or overnight. Seal ampoules with flame.

Media:

M1. Artificial Deep Lake vitamin agar (ADLVA) (Franzmann et al. 1988)

Basal Broth

NaCl	181·0 g
$MgCl_2 \cdot 6H_2O$	75·0 g
$MgSO_4 \cdot 7H_2O$	7·4 g
KCl	7·4 g
$CaCl_2 \cdot 2H_2O$	1·0 g
Distilled water to	1·0 L

Adjust the pH to 7·0 and store at 4°C.

Complete Medium

Yeast extract (Difco 0127-02)	0·1 g
Agar (Difco 0140-01)	1·5 g
Basal broth	100·0 mL

Combine the ingredients and boil to dissolve the agar. Sterilise and cool to 50°C. Aseptically add 1·0 mL of ADLV (Solution S5) and dispense.

M2. Artificial Deep Lake succinate vitamin agar (ADLSVA) (Franzmann et al. 1988)

Na succinate	1·0 g
ADLVA (Medium M1)	100·0 mL

Combine the ingredients and boil to dissolve the agar. Sterilise and cool to 50°C. Aseptically add 1·0 mL of ADLV (Solution S5) and dispense.

M3. Artificial Organic Lake peptone agar (AOLPA) (Franzmann et al. 1987)

NaCl	100·0 g
$MgCl_2 \cdot 6H_2O$	5·0 g
$MgSO_4 \cdot 7H_2O$	9·5 g
KCl	5·0 g
$CaCl_2 \cdot 2H_2O$	0·2 g
$(NH_4)_2SO_4$	0·1 g
KNO_3	0·1 g

Peptone (Difco 0118-01-8)	5·0 g
Yeast extract (Difco 0127-02)	1·0 g
Agar (Difco 0140-01)	15·0 g
Distilled water to	960·0 mL

Dissolve the ingredients, adjust the pH to 7·0 and add the agar. Boil to dissolve the agar. Sterilise then cool to 50°C. Aseptically add 20·0 mL of HMSS (Solution S2), 20·0 mL of PS (Solution S3) and 1·0 mL of AOLV (Solution S4).

M3a. AOLPA 3%

As in M3 (above) but with only 30 g NaCl per litre distilled water.

M4. Rhodospirillaceae agar (RA) (Biebl and Pfennig 1981)

Distilled water	1·0 L
KH_2PO_4	0·5 g
$MgSO_4 \cdot 7H_2O$	0·2 g
NaCl	0·4 g
NH_4Cl	0·4 g
$CaCl_2 \cdot 2H_2O$	0·05 g
Na succinate	1·0 g
Yeast extract (Difco 0127-02)	0·2 g
Trace element solution (Solution S6)	1·0 mL
Fe-citrate (0·1% aqueous solution)	5·0 mL
Agar (Difco 0140-01)	15·0 g

Dissolve the ingredients in the order given. Adjust the pH to 6·8. Add agar and boil to dissolve. Sterilise then cool to 50°C. Aseptically add 1·0 mL of cyanocobalamin solution (Solution S7).

M5. Seawater yeast extract agar (SWYA)

Filtered seawater (0·45 μm)	1·0 L
Yeast extract (Difco 0127-02)	1·0 g
Agar (Difco 0140-01)	15·0 g

Mix, boil to dissolve the agar and sterilise without prior pH adjustment.

M6. 1/2 Strength seawater agar (1/2 SWA)

Glucose	1·0 g
Na acetate·3H2O	1·0 g
Peptone (Difco 0118-01-8)	1·0 g
Yeast extract (Difco 0127-02)	0·1 g
Distilled water	500·0 mL
Filtered seawater	500·0 mL
Agar (Difco 0140-01)	15·0 g

Mix, boil to dissolve the agar and sterilise without prior pH adjustment.

M7. Seawater yeast peptone agar (SWYPA)

Yeast extract (Difco 0127-02)	3·0 g
Peptone (Difco 0118-01-8)	5·0 g
Distilled water	250 mL
Filtered seawater (0·45 μm)	750 mL
Agar (Difco 0140-01)	15·0 g

Adjust pH to 7·3. Boil to dissolve agar and sterilise.

M8. 1/3 Strength tryptone soya agar (1/3 Strength TSA)

Tryptone (Oxoid L42)	5·0 g
Soya peptone (Oxoid L44)	2·5 g
NaCl	2·5 g
Agar (Oxoid L11)	15·0 g
Distilled water	1·0 L

Adjust pH to 7·3. Add agar, boil to dissolve and sterilise.

M9. Zobells 2216 agar (ZA) (Zobell 1946)

Peptone (Difco 0118-01-8)	5·0 g
Yeast extract (Difco 0127-02)	1·0 g
$FePO_4$	0·01 g
Agar (Difco 0140-01)	15·0 g
Aged seawater	1·0 L

Store the seawater in the dark for at least three weeks before use. Sterilise without prior pH adjustment. Marine agar 2216 (Difco) prepared according to manufacturer's instructions can also be used.

M10. Microcyclus/Spirosoma agar (MSA) (Larkin et al. 1977)

Peptone (Difco 0118-01-8)	1·0 g
Yeast extract (Difco 0127-02)	1·0 g
Glucose	1·0 g
Agar (Difco 0140-01)	15·0 g
Distilled water	1·0 L
Option: NaCl	15·0 g

Sterilise without prior pH adjustment. Include 1·5% NaCl for marine isolates.

M11. Nutrient agar (NA) (Difco 0001-01-8)

Prepare according to manufacturer's instructions.

M12. Peptone yeast glucose agar (PYGA) (Inoue and Komagata 1976)

Peptone (Difco 0118-01-8)	10·0 g
Yeast extract (Difco 0127-02)	5·0 g
Glucose	3·0 g
Distilled water	1·0 L
Agar (Difco 0140-01)	15·0 g

Adjust the pH to 7·2. Add agar, boil to dissolve and sterilise.

M13. TSA-artificial marine salts (low sulphate)

For *Carnobacterium funditum* and *Carnobacterium alterfunditum*

Distilled water	1000.0 mL
K_2HPO_4	0·14 g
KCl	0·335 g
$MgCL_2 \cdot 2H_2O$	6·0 g
$MgSO_4 \cdot 7H_2O$	1·0 g
NH_4Cl	0·25 g
$CaCl_2 \cdot 2H_2O$	0·05 g
NaCl	20·0 g
$Fe(NH_4)_2(SO_4)_2 \cdot 7H_2O$	2·0 mg
Tryptic Soy Broth (Difco 0370-01-1)	30·0 g
Yeast Extract (Difco 0127-02)	3·0 g

Dissolve ingredients in order given. Final pH should be 7·3. Dispense and sterilise. For solid medium add 1·5% agar. Both *Carnobacterium* sp. grow better anaerobically than aerobically on agar, but grow well in unshaken broths. Optimum temperature is 23°C, but good growth is obtained at 10°C.

M14. Seawater lemco medium (SWL)

Lab Lemco powder (Oxoid L29)	10·0 g
Peptone (Difco 0118-01-8)	10·0 g
Aged seawater, filtered (0·45 μm)	750·0 mL
Distilled water	250·0 mL

Dissolve ingredients, heating if necessary. Adjust pH to 7·8, boil for 3–5 minutes and filter (Whatman No1). Readjust pH to 7·3 and sterilise. For solid media add 15 g of agar and boil to dissolve before sterilisation.

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